

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	)	Examiner: Hook, James
	)	
DOUGLAS SWINGLEY	)	Art Unit: 3752
	)	
SERIAL NO.: 10/631,382	)	
	)	
FILED: July 30, 2003	)	
	)	
FOR: CPVC DRAIN WASTE AND VENT	)	Mailed: January 28, 2005
FITTING	)	

DECLARATION OF GREGORY PEAK UNDER RULE 1.132

COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

1. I, Gregory Peak, declare that I am Director of Technical Services for Spears Manufacturing Company, the assignee of the present patent application (U.S. Patent Application Serial No. 10/631,382). I have been Director of Technical Services since 1994. Prior to that date, I was a manager of the Technical Services Department for about five years. Prior to that, I worked since 1986 as a product manager for Spears Manufacturing Company.

2. I am familiar with the knowledge of those of ordinary skill in the design and construction of DWV systems. This knowledge comes from my continuous working with engineers

and technicians employed by Spears Manufacturing Company, by frequent working with outside engineers and contractors regarding DWV products and projects, by frequent interaction with industry technical people at trade conferences and trade shows and by participation on ASTM committees.

3. I am also familiar with customer preferences regarding DWV fittings and pipe, including customer preferences regarding CPVC DWV fittings and pipe. I have gained this knowledge through frequent direct contact with customers and contractors with respect to DWV products and projects, through continuous contact with Spears sales representatives, through frequent attendance at trade conferences and trade shows, through participation on various ASTM committees and through interaction with field technical service specialists employed by Spears Manufacturing Company.

4. The information contained in this declaration is personally known to me or believed by me to be true based upon information and belief. If called to testify thereto, I could and would do so. The commercial sales information set forth in this declaration is summarized from business records kept in the ordinary course and scope of the business of Spears Manufacturing Company.

5. Spears Manufacturing Company has been selling CPVC fittings and pipe for DWV service (as claimed in the present application) for little more than three years. The sales of these products have demonstrated enormous commercial success as is demonstrated below.

6. Spears= CPVC fittings and pipe in DWV service provide excellent corrosion protection and is much easier and less expensive to install than pipes and fittings made from prior art materials. Such prior art materials include glass, stainless steel, lined steel, siliconized iron, polypropylene and polyvinylidene fluoride. Stainless steel and lined steel materials are much more expensive than CPVC materials. Glass and siliconized iron are subject to some corrosion problems and are difficult to handle and maintain. Polypropylene and polyvinylidene fluoride systems are generally resistant to corrosion, but are difficult and expensive to install. Both of these latter two materials require installation with complicated fusion equipment. Installation of these latter two materials is time-consuming, unreliable and can only be accomplished in accessible spaces. CPVC systems, on the other hand, show excellent corrosion resistance and can be easily assembled using simple adhesive methods. The use of such adhesive methods markedly decreases the cost to install and maintain these systems.

7. Although CPVC piping and fittings were previously known for non-DWV applications, their use in DWV systems was believed by those of ordinary skill in the art to be unsuitable.

This is because those of ordinary skill in the art believed that CPVC piping and fittings could not be adequately assembled so as to resist the corrosive atmospheres frequently found in DWV applications. This fear, however, turned out to be erroneous, much to the surprise of the industry.

8. As mentioned above, Spears Manufacturing Company has been selling CPVC fittings and pipe for DWV Service for a

little more than three years. The commercial success of this product has been quite astounding. This commercial success is best understood when compared with another product of Spears Manufacturing Company (LXT pipe and fitting systems) which was put on the market a little bit more than five years ago. LXT pipe and fitting systems appeal to another aspect of the market for similar reasons to that which appeals to purchasers of CPVC fittings and pipe systems, i.e., the inexpense of materials and the ease of installation over prior art fitting and piping systems for similar service. Sales of LXT products in LXT=s initial year was a little under \$100,000. In the second year, sales rose by about 300%. In the third year, however, sales fell by about 30%. In the fourth year, sales rose again by 46% and in the fifth year, sales rose again by 78%. By contrast, the CPVC products sold by Spears Manufacturing Company in its initial sales year was more than three times the sales of LXT Products sold in LXT=s first year. In its second year on the market, sales of CPVC fittings and pipe rose by an overwhelming 430%. Sales in the third year for CPVC fittings and pipe rose again by 80%. Thus, it can be seen that sales of CPVC fittings and pipe greatly outstripped the sales track record for LXT products.

9. In my opinion, the commercial success of CPVC fittings and pipe is due solely to its (surprising) resistance to corrosion in chemical waste disposal systems, combined with its inexpensive cost and its ease of installation relative to prior art products used for corrosive waste DWV systems.

10. Also, it is my opinion that the commercial success of CPVC fittings and pipe is independent of any advertising or marketing efforts made by Spears Manufacturing Company for these products. Spears Manufacturing Company invested very little in

marketing and advertising for its CPVC products. Such CPVC products are industrial products sold to industrial users and their contractors. Therefore, Spears Manufacturing Company's marketing efforts have been limited to the distribution of informational materials about those products. Moreover, the marketing and advertising efforts on behalf of CPVC fittings and pipe are very similar to the marketing and advertising efforts made on behalf of LXT fittings and pipe, whereas LXT fittings and pipe enjoyed no such similar spectacular commercial success.

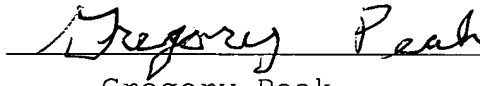
11. Moreover, it is my opinion that the commercial success of CPVC fittings and pipe is independent of any extraneous factors in the marketplace. There are no extraneous factors in the marketplace which would tend to encourage use of CPVC systems over systems made from other materials. The market for DWV fittings and pipe is largely the same since the introduction of CPVC fittings and pipe as it was before the introduction of CPVC fittings and pipe.

10. Finally, it is my opinion that the commercial success of CPVC fittings and pipe is wholly attributable to the CPVC material and its advantages rather than to any other attributes of the pipe or fittings. All CPVC pipe and fittings marketed by Spears Manufacturing Company are virtually identical in size and shape to DWV pipe and fittings made from other materials. All CPVC pipe and fittings marketed by Spears Manufacturing company conform to established standards in the industry for DWV pipe and fittings, including ASTM Standard D 3311-02, a true and copy of which is attached hereto as Exhibit A.

11. Accordingly, it is my opinion that DWV fittings made from CPVC and DWV systems made from CPVC pipe and fittings were not obvious to those of ordinary skill in the art at the time employees of Spears Manufacturing Company invented such products and systems. It was generally (and erroneously) believed by those of ordinary skill in the art that CPVC systems were unsuitable in DWV applications. The fact that CPVC fittings and piping systems have enjoyed spectacular commercial success underscores my opinion that CPVC fittings and piping systems for DWV service were not obvious to those of ordinary skill in the art at the time the invention was made.

I declare under penalty of perjury that the foregoing is true and correct, and that if called to testify thereto, I could and would so testify. All of the statements made in this Declaration are personally known to me to be true, and any statements made on information and belief are believed to be true. I further declare that I understand that willful false statements and the like are punishable by fine or imprisonment or both (18 U.S.C. ' 1001) and may jeopardize the validity of the application or any patent issuing thereon.

Executed this 27 day of January, 2005, at Sylmar, California.

  
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Gregory Peak



## Standard Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns<sup>1</sup>

This standard is issued under the fixed designation D 3311; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

1.1 This specification provides standard fitting geometries and laying lengths for plastic fittings intended for use in drain, waste, and vent applications.

1.2 Fittings meeting the requirements of this standard specification are designed for use with outside diameter controlled pipe. The inside diameter can vary significantly as the wall thickness and outside diameter varies and therefore is not suitable for use as a fitting socket.

1.3 The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are provided for information only.

### 2. Referenced Documents

#### 2.1 *ASTM Standards:*

D 2661 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe Fittings<sup>2</sup>

D 2665 Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings<sup>2</sup>

D 2749 Symbols for Dimensions of Plastic Pipe Fittings<sup>2</sup>

F 628 Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core<sup>2</sup>

F 891 Specification for Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core<sup>2</sup>

### 3. Requirements

3.1 Fittings shall conform to the geometries and laying lengths as shown in Tables 1-44 and Fig. 1. Tolerances shall be  $\pm 1/16$  in. unless otherwise specified.

3.2 Spigot and hub dimensions shall conform to the requirements of the referencing standard.

3.3 The exact outside shape of a fitting is not determined by the outline drawings shown in this specification but rather by the socket dimensions, wall thickness requirements, waterway, laying lengths, and any other critical dimensions that may be specified.

3.4 The pitch of sockets for patterns with 90° angles (except vent fittings) shall be  $1/4$  in./ft or 1° 12 min.

3.5 On double reducing sanitary tees, the G2 dimension on branches will be calculated on the larger size and centerlines shall remain the same for both branches.

3.6 All other dimensions, materials and property requirements shall be in conformance with the referencing standard.

### 4. Keywords

4.1 DWV; fittings; plastic; Schedule 40; thermoplastic

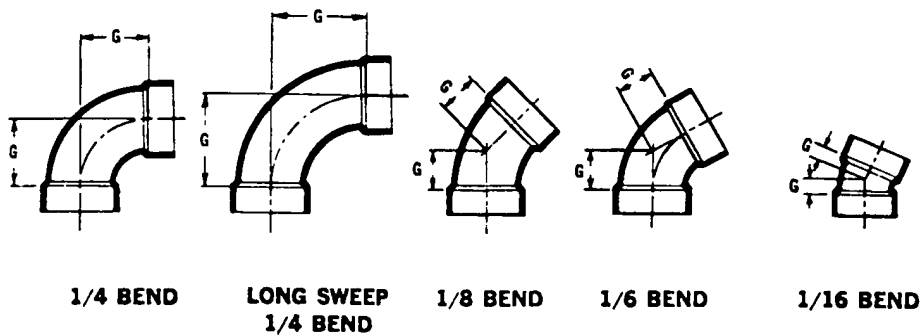
<sup>1</sup> This specification is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.63 on Drain, Waste, and Vent Pipe and Tube.

Current edition approved Dec. 10, 2002. Published July 2003. Originally approved in 1974. Last previous edition approved in 1994 as D 3311 – 94.

<sup>2</sup> *Annual Book of ASTM Standards*, Vol 08.04.

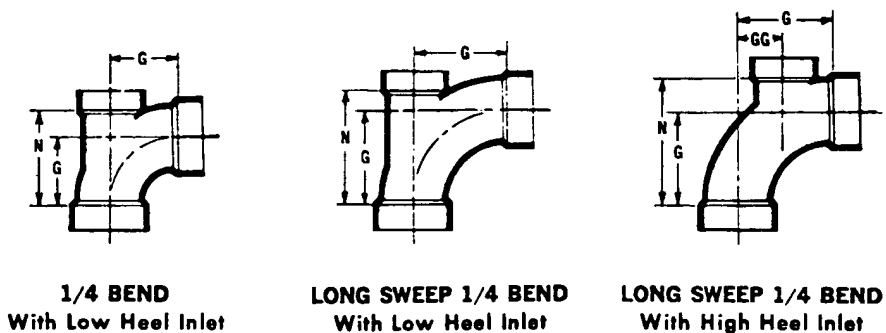


TABLE 1 Bends, in. (mm)



Nominal Pipe Size	1/4 Bend	Long Sweep 1/4 Bend	1/8 Bend	1/6 Bend	1/16 Bend
	G	G	G	G	G
1 1/4	1 1/16 (40)	2 1/4 (57)	1 (25)	7/8 (22)	7/16 (11)
1 1/2	1 3/4 (44)	2 3/4 (70)	1 1/8 (29)	1 (25)	1/2 (13)
2	2 5/16 (59)	3 1/4 (83)	1 1/2 (38)	1 1/8 (33)	1 1/16 (17)
3	3 1/16 (78)	4 1/16 (103)	1 3/4 (44)	1 1/4 (43)	1 3/16 (21)
4	3 7/8 (98)	4 15/16 (125)	2 3/16 (56)	2 1/16 (52)	1 (25)
6	5 (min) (127)	9 (229)	2 (min) (51)	3 3/8 (86)	1 1/2 (38)
8	6 (152)	...	2 1/16 (52)	...	1 1/2 (38)

TABLE 2 Bends with Inlets, in. (mm)

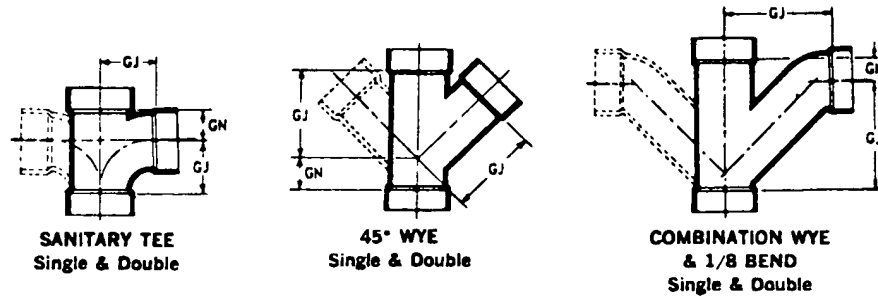


Nominal Pipe Size	1/4 Bend with Low Heel Inlet		Long-Sweep 1/4 Bend with Low Heel Inlet		Long-Sweep 1/4 Bend with High Heel Inlet		
	G	N	G	N	G	N	GG
3 by 3 by 1 1/2	3 1/16 (78)	4 3/16 (106)	4 1/16 (103)	4 3/4 (121)	...	...	...
3 by 3 by 2	3 1/16 (78)	4 7/16 (113)	4 3/16 (103)	4 15/16 (125)	4 1/16 (103)	5 5/8 (143)	2 1/4 (57)
4 by 4 by 2	3 7/8 (98)	5 1/16 (138)	4 15/16 (125)	6 (152)	...	...	...





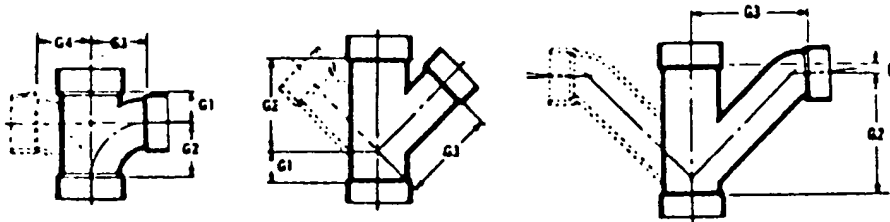
TABLE 3 Sanitary Tees, 45° Wyes, Combination Wyes and 1/8 Bends, in. (mm)



Nominal Pipe Size	Sanitary Tee Single and Double <sup>A</sup>		45° Wye, Single and Double		Combination Wye and 1/8 Bend Single and Double	
	GN	GJ	GN	GJ	GN	GJ
1¼	¾ (19)	1⅞ (40)	1⅞ (27)	2⅞ (65)	⅞ (11)	2⅞ (75)
1½	1 (25)	1¾ (44)	1⅞ (29)	2⅞ (73)	½ (13)	3⅞ (86)
2	1⅜ (35)	2⅞ (59)	1⅞ (35)	3⅞ (92)	1 (25)	4½ (114)
3	1⅞ (46)	3⅞ (78)	1⅞ (41)	5 (127)	1⅞ (29)	6⅞ (160)
4	2¼ (57)	3⅞ (98)	1⅞ (48)	6⅞ (162)	1⅞ (46) <sup>B</sup>	8⅞ (219)
6	3½ (89)	5 (127)	1¾ (44)	8⅞ (214)	<sup>B</sup>	<sup>B</sup>
8	4½ (114)	6 (152)	2⅞ (60)	11¼ (298)	<sup>B</sup>	<sup>B</sup>

<sup>A</sup>Non-reducing double sanitary tees are for vent use only.<sup>B</sup>Combination wye and 1/8 bend is assembled from two standard fittings.

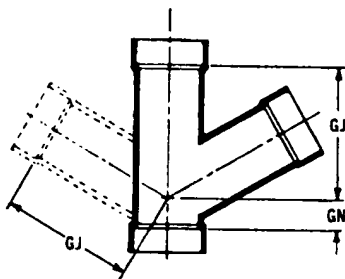
TABLE 4 Reducing Sanitary Tees, 45° Wyes, Combination Wyes, and 1/8 Bends, in. (mm)



Nominal Pipe Size	Sanitary Tee, Reducing Single and Double <sup>A</sup>				45° Wye, Reducing Single and Double			Combination Wye and 1/8 Bend Reducing Single and Double		
	G1	G2	G3	G4	G1	G2	G3	G1	G2	G3
1½ by 1¼ by 1¼	1⅞ (17) <sup>B</sup>	1½ (38) <sup>B</sup>	1⅞ (43) <sup>B</sup>	1⅞ (43) <sup>B</sup>	—	—	—	—	—	—
1½ by 1¼ by 1½	1 (25)	1¾ (44)	1¾ (44)	1¾ (44)	—	—	—	—	—	—
1½ by 1½ by 1¼	1⅞ (21)	1⅞ (43)	1⅞ (46)	1⅞ (46)	—	—	—	½ (13)	3¼ (83)	3⅞ (81)
2 by 1¼ by 1½	1⅞ (30)	1⅞ (49)	2⅞ (56)	2⅞ (56)	—	—	—	—	—	—
2 by 1½ by 1½	1⅞ (30)	1⅞ (49)	2⅞ (56)	2⅞ (56)	¾ (19) <sup>B</sup>	2⅞ (71) <sup>B</sup>	2⅞ (75) <sup>B</sup>	⅞ (14)	3⅞ (94)	3⅞ (92)
2 by 1½ by 2	1⅞ (35)	2⅞ (59)	2⅞ (59)	2⅞ (50)	1 (25) <sup>B</sup>	3½ (89) <sup>B</sup>	3⅞ (86) <sup>B</sup>	1 (25)	4½ (114)	4½ (114)
2 by 2 by 1¼	1⅞ (30)	1⅞ (49)	2⅞ (56)	2⅞ (56)	—	—	—	—	—	—
2 by 2 by 1½	1⅞ (30)	1⅞ (49)	2⅞ (56)	2⅞ (56)	1⅞ (27)	3⅞ (84)	3⅞ (87)	⅞ (14)	3⅞ (170)	3⅞ (92)
3 by 3 by 1½	1⅞ (24)	1¾ (44)	2⅞ (65)	2⅞ (65)	½ (13)	3¼ (95)	4⅞ (110)	½ (3)	3⅞ (87)	4¼ (108)
3 by 3 by 2	1⅞ (30)	2⅞ (54)	2⅞ (73)	2⅞ (73)	⅞ (22)	4⅞ (105)	4⅞ (117)	⅞ (11)	4¾ (121)	5⅞ (135)
3 by 3 by 2 by 1½	1⅞ (24) <sup>B</sup>	2⅞ (52) <sup>B</sup>	2⅞ (62) <sup>B</sup>	2⅞ (64) <sup>B</sup>	—	—	—	—	—	—
4 by 4 by 1½	1⅞ (27) <sup>B</sup>	2 (51) <sup>B</sup>	3¼ (83) <sup>B</sup>	3¼ (83) <sup>B</sup>	0 (0) <sup>B</sup>	3⅞ (84) <sup>B</sup>	3⅞ (100) <sup>B</sup>	—	—	—
4 by 4 by 2	1⅞ (29)	2⅞ (52)	3⅞ (84)	3⅞ (84)	¾ (10)	4⅞ (119)	5⅞ (141)	⅞ (8)	4¾ (121)	5⅞ (149)
4 by 4 by 3	1¾ (44)	—	3⅞ (90)	3⅞ (90)	1⅞ (27)	5⅞ (141)	6 (152)	1⅞ (27)	6⅞ (162)	6⅞ (175)
6 by 6 by 3	—	—	—	—	¾ (5) <sup>B</sup>	6⅞ (176) <sup>B</sup>	7⅞ (189) <sup>B</sup>	1⅞ (17) <sup>B</sup>	7⅞ (198) <sup>B</sup>	8⅞ (224) <sup>B</sup>
6 by 6 by 4	2⅞ (56) <sup>B</sup>	3⅞ (92) <sup>B</sup>	4⅞ (110) <sup>B</sup>	4⅞ (110) <sup>B</sup>	¾ (5) <sup>B</sup>	6⅞ (170) <sup>B</sup>	7⅞ (189) <sup>B</sup>	¾ (14) <sup>B</sup>	7⅞ (198) <sup>B</sup>	8⅞ (227) <sup>B</sup>
8 by 8 by 4	2⅞ (67)	4¼ (105)	5¼ (133)	5¼ (133)	¾ (10)	7⅞ (194)	8⅞ (219)	<sup>C</sup>	<sup>C</sup>	<sup>C</sup>
8 by 8 by 6	3⅞ (90)	4⅞ (122)	5½ (140)	5½ (140)	1 (25)	9½ (241)	9⅞ (249)	<sup>C</sup>	<sup>C</sup>	<sup>C</sup>

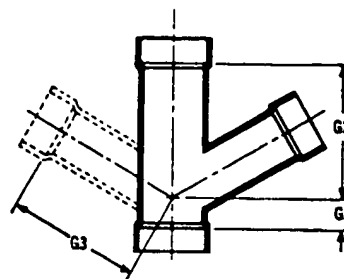
<sup>A</sup>Non-reducing double sanitary tees are for vent use only.<sup>B</sup>This dimension is a minimum with no upper maximum limit.<sup>C</sup>Combination Wye and 1/8 bend is assembled from two standard fittings.

**TABLE 5 60° Wyes, Single, and Double, in. (mm)**



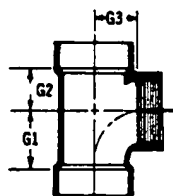
Nominal Pipe Size	GN	GJ
1½	1½ (40)	2½ (73)
2	1¾ (37)	3¾ (92)
3	1¾ (37)	5 (127)

**TABLE 8 60° Reducing Wyes, Single and Double, in. (mm)**



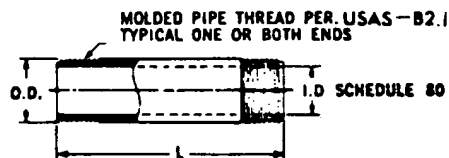
Nominal Pipe Size	G1	G2	G3
2 by 2 by 1½	1¼ (27)	3¼ (87)	3¼ (87)
3 by 3 by 1½	½ (13)	3¼ (95)	4¾ (110)
3 by 3 by 2	⅞ (22)	4¾ (105)	4¾ (117)

**TABLE 6 Fixture Tees, in. (mm)**



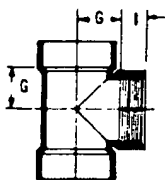
Nominal Pipe Size	G1	G2	G3
1½	1⅞ (40)	1⅞ (30)	1¼ (32)
2 by 1½ by 1½	1⅞ (37)	1⅞ (30)	1¼ (32)
2 by 2 by 1½	1⅞ (37)	1⅞ (33)	1¼ (32)

**TABLE 9 Molded Nipples, in. (mm)**



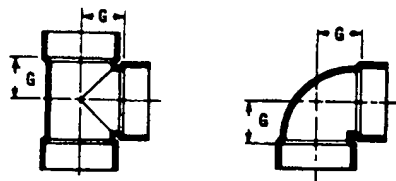
Nominal Pipe Size	OD	ID	Length
1½	1.900	1.500	½ in. increments from close to 18 in. long
2	2.375	1.939	
3	3.500	2.900	

**TABLE 7 Cleanout Tees, in. (mm)**



Nominal Pipe Size	G	I
1½	1⅞ (30)	⅝ (16)
2	1½ (38)	⅝ (16)
3	1⅞ (48)	¾ (19)
4	2½ (64)	⅞ (22)

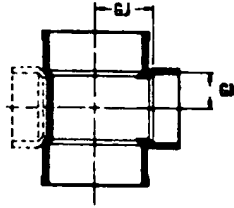
**TABLE 10 Vent Tees and ¼ Bend Vents, in. (mm)**



Nominal Pipe Size	Vent Tee	¼ Bend Vent
1¼	1 (25)	1 (25)
1½	1⅞ (30)	1⅞ (30)
2	1½ (38)	1½ (38)
3	1⅞ (48)	1⅞ (48)
4	2½ (64)	2½ (64)

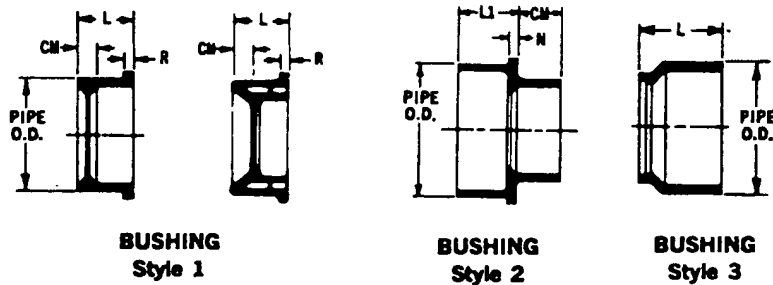


TABLE 11 Reducing Vent Tees, Single, and Double, in. (mm)



Nominal Pipe Size	GN	GJ
2 by 1½ by 1½	1⅜ (30)	1½ (38)
2 by 2 by 1½	1⅜ (30)	1½ (38)
3 by 3 by 1½	1⅜ (30)	1⅞ (48)
3 by 3 by 2	1½ (38)	1⅞ (48)

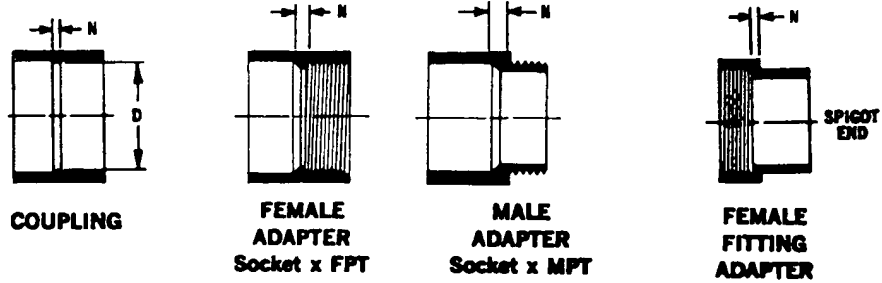
TABLE 12 Bushings, in. (mm)



Nominal Pipe Size	Style 1 (a and b) <sup>4</sup>			Style 2			Style 3
	L	CM	R	L1	CM	N	L
1½ by 1¼	1⅝ (24)	⅜ (5)	⅜ (5)	...	...	...	1 (25)
2 by 1¼	1⅞ (27)	⅝ (8)	⅜ (5)	...	...	...	1⅞ (29)
2 by 1½	1⅞ (27)	⅝ (8)	⅜ (5)	...	...	...	1⅜ (28)
3 by 1½	1¾ (44)	1 (25)	¼ (6)	1¾ (44)	¾ (19)	¼ (6)	1½ (38)
3 by 2	1¾ (44)	⅞ (22)	¼ (6)	1¾ (44)	⅞ (22)	¼ (6)	1⅞ (41)
4 by 2	2 (51)	1⅞ (29)	¼ (6)	2 (51)	⅞ (22)	¼ (6)	...
4 by 3	2 (51)	½ (13)	¼ (6)	2 (51)	1½ (38)	¼ (6)	...
6 by 4	3½ (89)	1¾ (44)	½ (13)	...	...	...	...
8 by 4	4⅝ (117)	2⅞ (73)	⅝ (16)	...	...	...	...
8 by 6	4⅝ (117)	1⅞ (41)	⅝ (16)	...	...	...	...

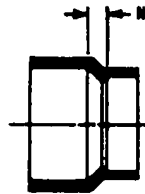
<sup>4</sup>No less than four ribs shall be used to support walls.

**TABLE 13 Couplings, Adapters, in. (mm)**



Nominal Pipe Size	Coupling	Female Adapter		Male Adapter		Female Fitting Adapter
	<i>D</i>	<i>N</i> , min	<i>N</i> , min	<i>N</i> , min	<i>A</i> , max	<i>N</i> , min
1¼	1.600 to 1.380	⅛ (3)	¼ (6)	⅜ (5)	1.290 (32.77)	⅜ (4)
1½	1.840 to 1.610	⅛ (3)	¼ (6)	⅜ (5)	1.552 (39.42)	⅜ (4)
2	2.320 to 2.067	⅛ (3)	¼ (6)	⅜ (5)	2.067 (52.50)	⅜ (4)
3	3.440 to 3.068	⅜ (5)	⅝ (8)	⅝ (10)	3.068 (77.93)	⅜ (6)
4	4.440 to 4.026	¼ (6)	1½ (9)	⅝ (10)	4.026 (102.26)	¼ (6)
6	6.550 to 6.065	¼ (6)	...	...	...	...
8	8.655 to 8.610	¼ (6)	...	...	...	...

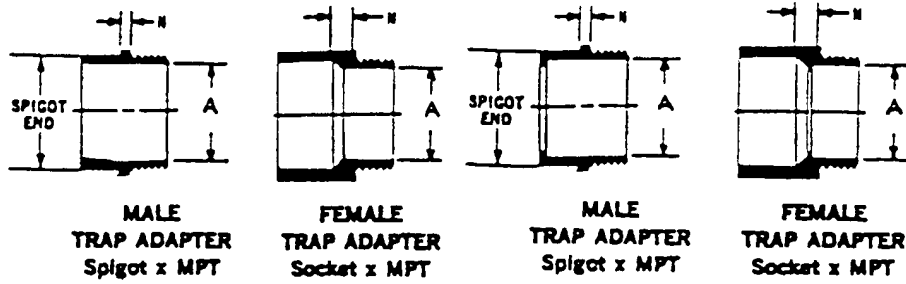
**TABLE 14 Pipe Increases, in. (mm)**



Nominal Pipe Size	<i>N</i> , min
1¼ by 1½	1⅜ (10)
1½ by 2	1⅞ (13)
1½ by 3	1⅞ (28)
2 by 3	⅞ (22)
2 by 4	1⅞ (35)
3 by 4	1⅞ (24)

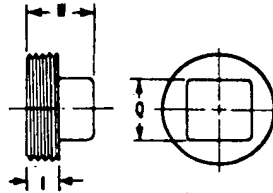


TABLE 15 Trap Adapters, in. (mm)



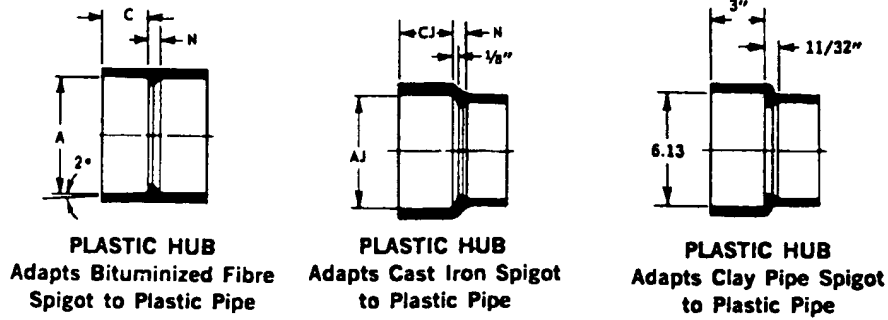
Without stop		With Stop
Nominal Pipe Size	N, min	A, min
1¼	¾ (5)	1.250 (32)
1½	¾ (5)	1.500 (38)
2	¾ (5)	2.000 (51)
1¼ by 1½	¾ (5)	1.250 (32)

TABLE 16 Pipe Plugs, in. (mm)



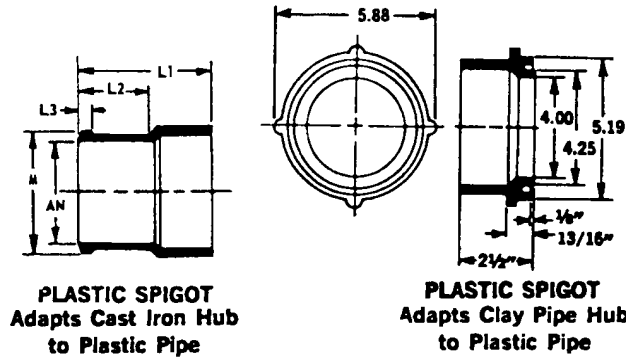
Nominal Pipe Size	L	W	Q
1¼	½ (13)	1 (25)	1 (25)
1½	¾ (16)	1½ (35)	1 (25)
2	¾ (16)	1¾ (35)	1¼ (32)
2½	¾ (19)	1½ (38)	1¼ (32)
3	¾ (19)	1¾ (44)	1½ (41)
3½	¾ (19)	1¾ (44)	1½ (41)
4	¾ (22)	1¾ (48)	2 (51)

TABLE 17 Hubs, in. (mm)



Nominal Pipe Size	A	C	N	AJ	CJ	N
2	...	...	...	2.94 (74.7)	2 7/8 (60)	3/8 (10)
3	3.448 (87.58)	1 11/16 (43)	5/16 (8)	3.94 (100.1)	2 7/8 (67)	7/16 (11)
4	4.493 (114.12)	1 15/16 (49)	1 1/32 (9)	4.94 (125.5)	2 7/8 (73)	1/2 (13)
Reducing 4 by 3	4.493 (114.12)	1 15/16 (49)	5/16 (8)	4.94 (125.5)	2 7/8 (73)	7/16 (11)

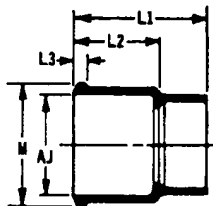
TABLE 18 Spigots, in. (mm)



Nominal Pipe Size	L2, min	L1, min	L3, min	M		AN
				max	min	
2	3 1/2 (89)	4 5/8 (117)	3/8 (10)	2.75 (69.9)	2.63 (66.8)	2.00 (50.8)
3	3 3/4 (95)	5 5/8 (143)	3/8 (10)	3.88 (98.6)	3.63 (92.2)	3.00 (76.2)
4	4 (102)	6 1/8 (156)	3/8 (10)	4.88 (124.0)	4.63 (117.6)	4.00 (101.6)



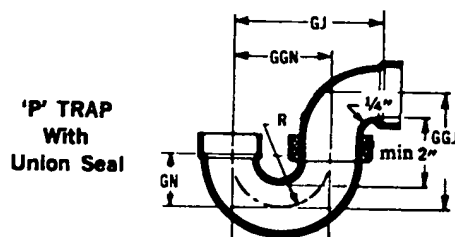
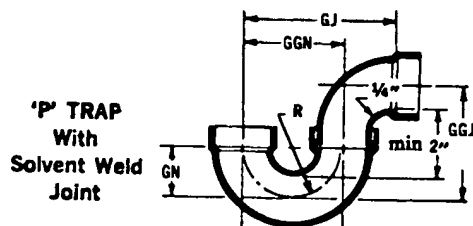
TABLE 19 Reducing Spigots, in. (mm)



**PLASTIC SPIGOT, Reducing**  
**Adapts Cast Iron Hub**  
**to Plastic Pipe**

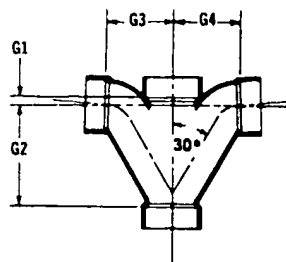
Nominal Pipe Size	L2 min	L1 min	L3 min	M		AJ
				max	min	
2 by 1½	3½ (89)	4¼ (108)	¾ (10)	2.75 (69.9)	2.63 (66.8)	2.00 (50.8)
3 by 1½	3¾ (95)	4½ (114)	¾ (10)	3.88 (98.6)	3.63 (92.2)	3.00 (76.2)
3 by 2	3¾ (95)	4¾ (117)	¾ (10)	3.88 (98.6)	3.63 (92.2)	3.00 (76.2)
4 by 2	4 (102)	4¾ (124)	¾ (10)	4.88 (124.0)	4.63 (117.6)	4.00 (101.6)
4 by 3	4 (102)	5½ (140)	¾ (10)	4.88 (124.0)	4.63 (117.6)	4.00 (101.6)

TABLE 20 P Traps, in. (mm)



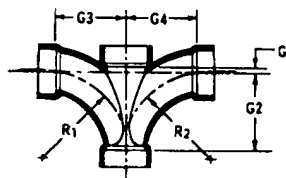
Nominal Pipe Size	min GJ	min GGJ	min GGN	min GN	min R
1¼	4½ (105)	3¾ (86)	3 (76)	1¾ (35)	1¾ (41)
1½	4¾ (107)	3¾ (92)	3 (76)	1¾ (35)	1¾ (41)
2	7¼ (184)	4¼ (103)	5 (127)	2¼ (57)	2½ (64)
3	8¾ (214)	6¾ (160)	6¼ (159)	2¾ (67)	3¾ (79)
4	10¾ (275)	7¾ (200)	8¼ (205)	3¾ (87)	4¼ (103)

TABLE 21 Double Fixture Fitting, in. (mm)



Nominal Pipe Size	G1	G2	G3	G4
1½	¾ (10)	3⅞ (90)	2⅞ (62)	2⅞ (62)
2	¾ (10)	4⅞ (116)	3⅞ (78)	3⅞ (78)
3	½ (13)	6¾ (171)	4½ (114)	4½ (114)
Reducing:				
2 by 1½ by 1½ by 1½	¾ (10)	3⅞ (90)	2⅞ (62)	2⅞ (62)
2 by 1½ by 2 by 2	¾ (10)	4⅞ (116)	3⅞ (78)	3⅞ (78)
2 by 1½ by 2 by 1½	¾ (10)	4⅞ (116)	3⅞ (78)	3⅞ (78)

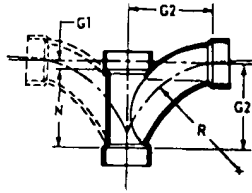
TABLE 22 Double Fixture Fitting, in. (mm)



Interchanges with Double Fixture Fittings						
Nominal Pipe Size	Double Fixture Fitting					
	G1	G2	G3	G4	R1	R2
1½	¾ (10)	3⅞ (79)	2⅞ (68)	2⅞ (68)	3⅞ (92)	3⅞ (92)
2	¾ (10)	4¼ (108)	3½ (89)	3½ (89)	4½ (114)	4½ (114)
3	½ (13)	6¼ (159)	4⅞ (125)	4⅞ (125)	6⅞ (168)	6⅞ (168)
Reducing						
2 by 1½ by 1½ by 1½	¾ (10)	3⅞ (79)	2⅞ (73)	2⅞ (73)	3⅞ (92)	3⅞ (92)
2 by 1½ by 1½ by 2	¾ (10)	4¼ (108)	2⅞ (73)	3½ (69)	3⅞ (92)	4½ (114)
2 by 1½ by 2 by 2	¾ (10)	4¼ (108)	3½ (89)	3½ (89)	4½ (114)	4½ (114)
3 by 2 by 3 by 3	½ (13)	6¼ (159)	4⅞ (125)	4⅞ (125)	6⅞ (168)	6⅞ (168)

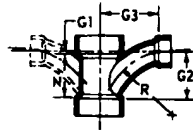


TABLE 23 Single and Double Long Turn Tee, in. (mm)

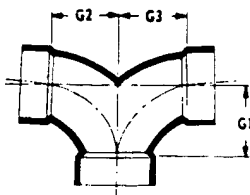


Interchanges with Combination Wye 1 / 8 Bend				
Nominal Pipe Size	Single and Double Long Turn Tee			
	G1	G2	N	R
1¼	¾ (10)	37/16 (87)	3¼ (78)	4¾ (121)
1½	7/16 (11)	315/16 (100)	3½ (89)	57/8 (149)
2	11/16 (17)	5½ (130)	47/16 (113)	7 (178)
3	11/16 (27)	79/16 (192)	6½ (165)	10½ (257)
4	1½ (38)	10 (254)	8½ (216)	13¼ (337)
6	2½ (64)	15¾ (391)	127/8 (327)	19 (483)

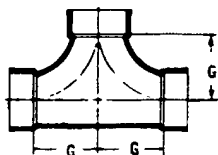
TABLE 24 Single and Double Long Turn Tee Reducing, in. (mm)



Interchanges with Reducing Combination Wye 1 / 8 Bend					
Nominal Pipe Size	Single and Double Long Turn Tee Reducing				
	G1	G3	N	G2	R
1½ by 1¼ by 1¼	¾ (10)	3¾ (92)	31/16 (78)	37/16 (87)	4¾ (121)
1½ by 1½ by 1¼	¾ (10)	3¾ (92)	31/16 (78)	37/16 (87)	4¾ (121)
2 by 1½ by 1½	7/16 (11)	4¾ (107)	3½ (89)	315/16 (100)	57/8 (200)
2 by 1½ by 2	11/16 (17)	5½ (130)	47/16 (113)	5½ (130)	7 (178)
2 by 2 by 1¼	¾ (10)	313/16 (97)	31/16 (78)	37/16 (87)	4¾ (121)
2 by 2 by 1½	7/16 (11)	4¾ (102)	3½ (89)	315/16 (100)	57/8 (149)
3 by 3 by 1½	7/16 (11)	4¾ (121)	3½ (89)	315/16 (100)	57/8 (149)
3 by 3 by 2	11/16 (17)	511/16 (128)	47/16 (113)	5½ (130)	7 (178)
4 by 4 by 1½	¾ (10)	5¾ (132)	3¾ (90)	315/16 (100)	57/8 (149)
4 by 4 by 2	5/8 (16)	6½ (156)	4½ (114)	5½ (130)	7 (178)
4 by 4 by 3	11/16 (27)	81/16 (205)	6½ (165)	79/16 (192)	10½ (257)
6 by 6 by 2	9/16 (14)	71/8 (181)	49/16 (116)	5½ (130)	7 (178)
6 by 6 by 3	19/16 (24)	91/16 (230)	6½ (168)	79/16 (192)	10½ (257)
6 by 6 by 4	1½ (38)	11 (279)	8½ (216)	10 (254)	13¼ (337)
6 by 6 by 5	2 (51)	13¾ (338)	10¾ (273)	12¾ (324)	16 (406)

**D 3311 – 02****TABLE 25 Three-Way Ell, in. (mm)**

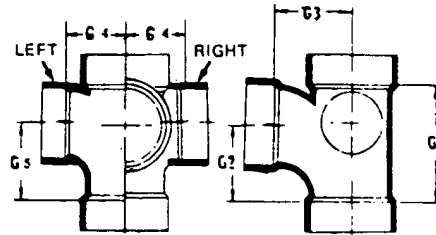
Nominal Pipe Size	G1	G2	G3
1½	1¾ (44)	1¾ (44)	1¾ (44)
2	2⅝ (59)	2⅝ (59)	2⅝ (59)
3	3⅞ (78)	3⅞ (78)	3⅞ (78)
4	3⅞ (98)	3⅞ (98)	3⅞ (98)
Reducing			
2 by 1½ by 1½ (short)	1⅝ (41)	1⅝ (41)	1⅝ (41)
3 by 2 by 3	3⅞ (78)	2⅞ (73)	3⅞ (78)
2 by 1½ by 1½ (long)	1⅝ (49)	2⅞ (56)	2⅞ (56)

**TABLE 26 Two Way Cleanout, in. (mm)**

Nominal Pipe Size	G
3	4⅞ (103)
4	4⅝ (125)

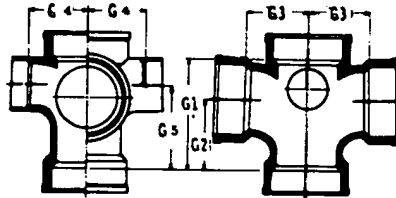


TABLE 27 Sanitary Tees, with Side Inlet, in. (mm)



Nominal Pipe Size	G1	G2	G3	G4	G5
<b>Left-Hand Side Inlet</b>					
1½ by 1½ by 1½ by 1½	2¾ (70)	1¾ (44)	1¾ (44)	1¾ (44)	1¾ (44)
2 by 2 by 1½ by 1½	3⅞ (94)	2⅞ (59)	2⅞ (59)	2⅞ (59)	2⅞ (59)
3 by 3 by 2 by 1½	3⅞ (84)	2⅞ (54)	2⅞ (73)	2⅞ (65)	2⅞ (54)
3 by 3 by 2 by 2	3⅞ (84)	2⅞ (54)	2⅞ (73)	2⅞ (73)	2⅞ (54)
3 by 3 by 3 by 1½	4⅞ (124)	3⅞ (78)	3⅞ (78)	2⅞ (65)	3⅞ (94)
3 by 3 by 3 by 2	4⅞ (124)	3⅞ (78)	3⅞ (78)	2⅞ (73)	3⅞ (94)
4 by 4 by 4 by 2	6⅞ (156)	3⅞ (98)	3⅞ (98)	3⅞ (84)	5 (127)
<b>Right-Hand Side Inlet</b>					
3 by 3 by 2 by 1½	3⅞ (84)	2⅞ (54)	2⅞ (73)	2⅞ (65)	2⅞ (54)
3 by 3 by 2 by 2	3⅞ (84)	2⅞ (54)	2⅞ (73)	2⅞ (73)	2⅞ (54)
3 by 3 by 3 by 1½	4⅞ (124)	3⅞ (78)	3⅞ (78)	2⅞ (65)	3⅞ (94)
3 by 3 by 3 by 2	4⅞ (124)	3⅞ (78)	3⅞ (78)	2⅞ (73)	3⅞ (94)
4 by 4 by 4 by 2	6⅞ (156)	3⅞ (98)	3⅞ (98)	3⅞ (84)	5 (127)
<b>Side Inlet Both Sides</b>					
3 by 3 by 2 by 1½ by 1½	3⅞ (84)	2⅞ (54)	2⅞ (73)	2⅞ (65)	2⅞ (54)
3 by 3 by 2 by 2 by 2	3⅞ (84)	2⅞ (54)	2⅞ (73)	2⅞ (73)	2⅞ (54)
3 by 3 by 3 by 1½ by 1½	4⅞ (124)	3⅞ (78)	3⅞ (78)	2⅞ (65)	3⅞ (94)
3 by 3 by 3 by 2 by 2	4⅞ (124)	3⅞ (78)	3⅞ (78)	2⅞ (73)	3⅞ (94)
4 by 4 by 4 by 2 by 2	6⅞ (156)	3⅞ (98)	3⅞ (98)	3⅞ (84)	5 (127)

TABLE 28 Sanitary Tee, Double with Side Inlets, in. (mm)



Nominal Pipe Size	G1	G2	G3	G4	G5
<b>Single Side Inlet</b>					
3 by 3 by 3 by 3 by 1½	4⅞ (124)	3⅞ (78)	3⅞ (78)	2⅞ (65)	3⅞ (94)
3 by 3 by 3 by 3 by 2	4⅞ (124)	3⅞ (78)	3⅞ (78)	2⅞ (73)	3⅞ (94)
4 by 4 by 4 by 4 by 2	6⅞ (156)	3⅞ (98)	3⅞ (98)	3⅞ (84)	3⅞ (min) (98)
<b>Inlet Both Sides</b>					
3 by 3 by 3 by 3 by 1½ by 1½	4⅞ (124)	3⅞ (78)	3⅞ (78)	2⅞ (65)	3⅞ (94)
3 by 3 by 3 by 3 by 2 by 2	4⅞ (124)	3⅞ (78)	3⅞ (78)	2⅞ (73)	3⅞ (94)
4 by 4 by 4 by 4 by 2 by 2	6⅞ (156)	3⅞ (98)	3⅞ (98)	3⅞ (84)	5 (127)

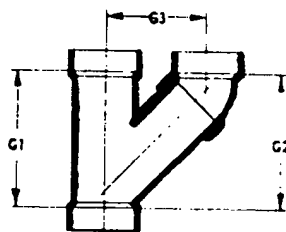


TABLE 29 Sanitary Tees, with Slip Joint, in. (mm)



Nominal Pipe Size	Sanitary Tee			Sanitary Tee Through Wall		
	G1	G2	G3, min	G1	G2	G3, min
1¼	2¼ (57)	1½ (38)	2⅜ (56)	2¼ (57)	1½ (38)	3 (76)
1½	2¾ (70)	1¾ (44)	2⅞ (62)	2¾ (70)	1¾ (44)	3 (76)
1½ by 1¼ by 1½	2½ (64)	1¾ (44)	2⅞ (62)	2½ (64)	1¾ (44)	3 (76)

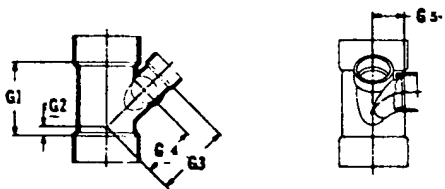
TABLE 30 Upright Wye, in. (mm)



Nominal Pipe Size	G1 min	G2 min	G3 min
2 by 2 by 2	5½ (140)	5⅝ (132)	3¾ (95)
3 by 3 by 3	7½ (191)	7⅞ (187)	5¼ (133)
Reducing			
2 by 2 by 1½	4¼ (108)	4⅞ (105)	3⅞ (78)
3 by 3 by 2	5⅝ (132)	5⅞ (135)	4⅞ (116)

TABLE 31 Single 45° Wye, with Auxiliary Inlet, in. (mm)

NOTE—RH.AI = Right Hand Auxiliary Inlet  
 LH.AI = Left Hand Auxiliary Inlet  
 DBL.AI = Double Auxiliary Inlets  
 V = Vent



Nominal Pipe Size	G1	G2	G3	G4	G5
3 by 3 by 1½ V by 1½ RH.AI	4¼ (108)	½ (13)	4⅞ (110)	3⅞ (81)	1¾ (44)
3 by 3 by 1½ V by 1½ LH.AI	4¼ (108)	½ (13)	4⅞ (110)	3⅞ (81)	1¾ (44)
3 by 3 by 2 V by 2 RH.AI	5 (127)	⅞ (22)	4⅞ (117)	3¼ (83)	2⅞ (59)
3 by 3 by 2 V by 2 LH.AI	5 (127)	⅞ (22)	4⅞ (117)	3¼ (83)	2⅞ (59)



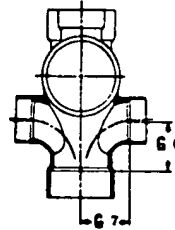
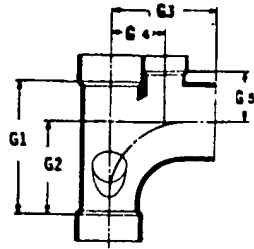
TABLE 32 Vertical Closet Bend, with Auxiliary Inlets, in. (mm)

NOTE—RH.AI = Right Hand Auxiliary Inlet

LH.AI = Left Hand Auxiliary Inlet

DBL.AI = Double Auxiliary Inlets

V = Vent



Nominal Pipe Size	G1	G2	G3	G4	G5	G6	G7
3 by 3 by 4 by 2V by 2 RH.AI	7½ (191)	5¾ (137)	6½ (156)	3¾ (80)	2¾ (70)	2⅞ (73)	2⅞ (73)
3 by 3 by 4 by 2V by 2 LH.AI	7½ (191)	5¾ (137)	6½ (156)	3¾ (80)	2¾ (70)	2⅞ (73)	2⅞ (73)
3 by 3 by 4 by 2V by 2 by 2 DBL.AI	7½ (191)	5¾ (137)	6½ (156)	3¾ (80)	2¾ (70)	2⅞ (73)	2⅞ (73)

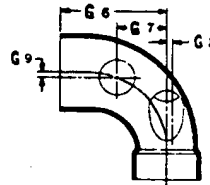
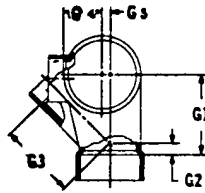
TABLE 33 Horizontal Closet Bend, with Auxiliary Inlets, in. (mm)

NOTE—RH.AI = Right Hand Auxiliary Inlet

LH.AI = Left Hand Auxiliary Inlet

DBL.AI = Double Auxiliary Inlets

V = Vent



Nominal Pipe Size	G1	G2	G3	G4	G5	G6	G7	G8	G9
3 by 4 by 2V by 2 RH.AI	4⅝ (117)	⅞ (14)	4½ (114)	2⅞ (59)	1⅝ (12)	6⅜ (157)	2⅞ (73)	⅞ (7)	¼ (6)
3 by 4 by 2V by 2 LH.AI	4⅝ (117)	⅞ (14)	4½ (114)	2⅞ (59)	1⅝ (12)	6⅜ (157)	2⅞ (73)	⅞ (7)	¼ (6)

**TABLE 34 Strainer Adapter, in. (mm)**



**TRAY PLUG ADAPTER**  
Fem. NPSM x Spigot

**TRAY PLUG ADAPTER**  
Fem. NPSM x Hub

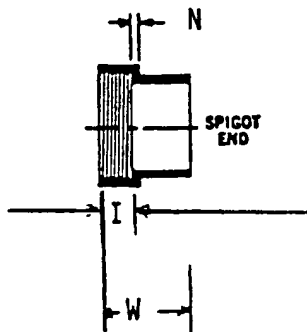
Nominal Pipe Size	Fem. NPSM × Spigot	Fem. NPSM × Hub
	L	L, min
1½	3⅞ (86)	1⅞ (48)

**TABLE 35 Swivel Strainer, Adapter, in. (mm)**



Nominal Pipe Size	Short		Long	
	L1	L2	L1	L2
1½	1⅞ (43)	⅞ (16)	2⅞ (62)	⅞ (16)

**TABLE 36 Cleanout Female Fitting Adapter, in. (mm)**



Nominal Pipe Size	N, min	I, min	W, min
1¼	⅝ (4)	½ (13)	1⅞ (34)
1½	⅝ (4)	⅝ (16)	1⅞ (37)
2	⅝ 7/32 (4)	⅝ (16)	1⅞ (39)
3	(6)	¾ (19)	2⅞ (63)
4	¾ (6)	⅞ (22)	2¾ (70)

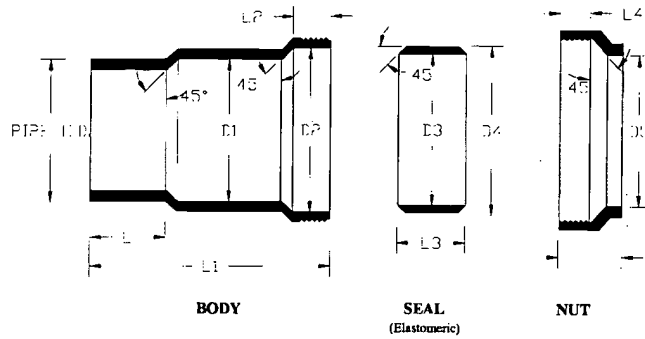


TABLE 37 Cut-In Adapter

NOTE 1—Adjustable plastic ring optional.

NOTE 2—Knockout optional in all configurations.

NOTE 3—Adjustable metal ring optional and must be protected by a corrosion-resisant coating.

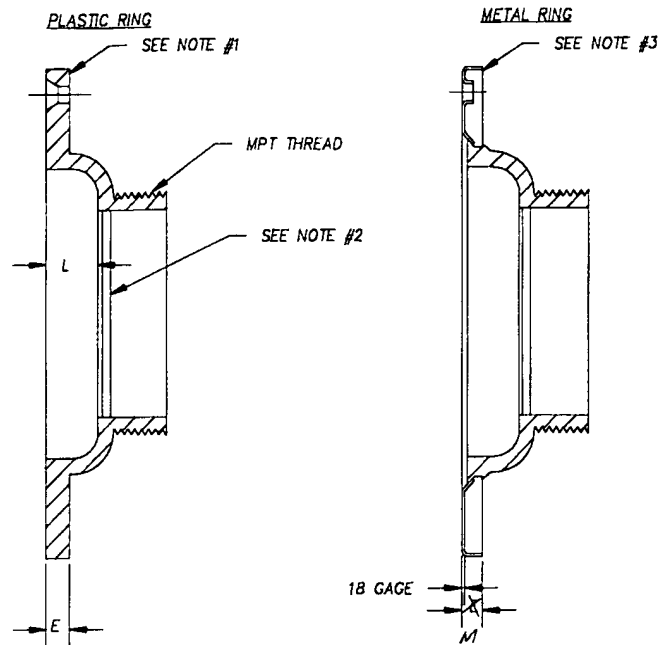


Minimum Dimensions, in. (mm)

	1½	2	3	4
L	...	1¼ (32)	...	...
L1	...	2½ (64)	...	...
L2	...	0.60 (15.2)	...	...
L3	...	1 (25)	...	...
L4	...	0.53 (13.5)	...	...
L5	...	1¼ (32)	...	...
D1	...	2.385 (60.58)	...	...
D2	...	2.940 (74.69)	...	...
D3	...	2.380 (60.45)	...	...
D4	...	2.577 (65.46)	...	...
D5	...	2.385 (60.58)	...	...



TABLE 38 4 by 3 in. Closet Flange (MPT)



M (min)	E (min)	L (min)	TH'D (min)
17/32 (5 1/2)	1/4 (6)	3/4 (18)	3"-8

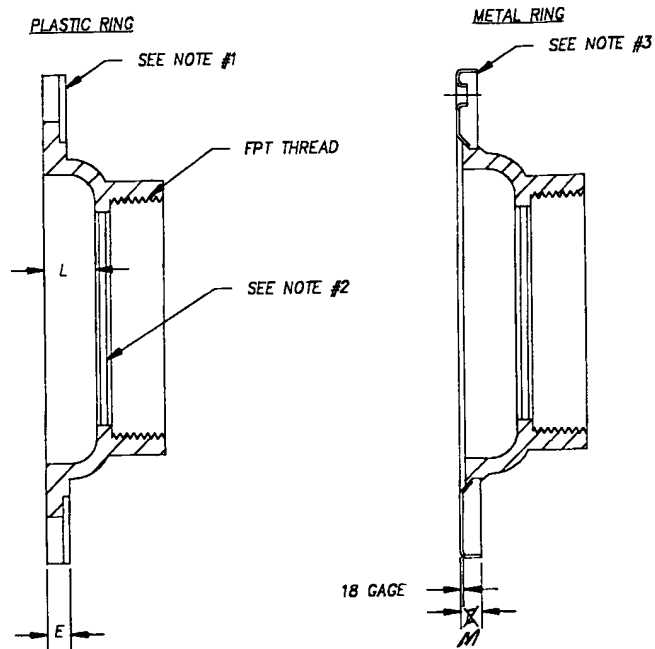


TABLE 39 4 by 3 in. Threaded Closet Flange (FPT)

NOTE 1—Adjustable plastic ring optional.

NOTE 2—Knockout optional in all configurations.

NOTE 3—Adjustable metal ring optional and must be protected by a corrosion-resisant coating.



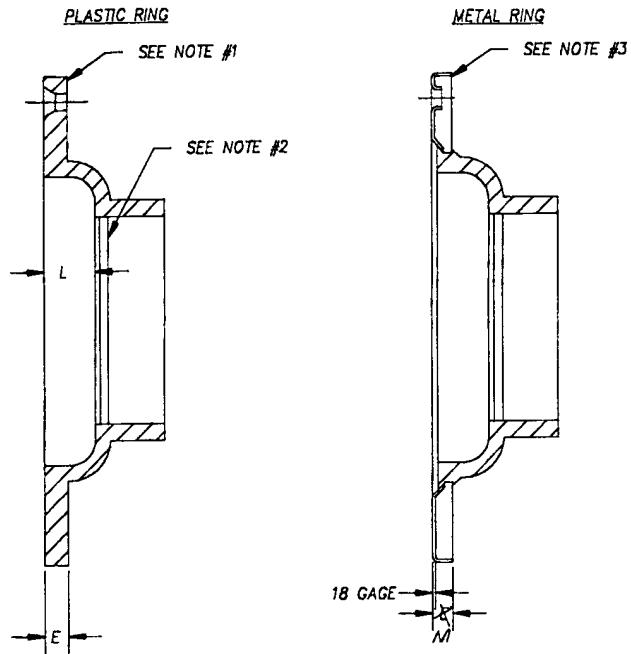
M (min)	E (min)	L (min)	TH'D (min)
7/32 (5 1/2 )	1/4 (6)	3/4 (18)	3"-8

TABLE 40 4 by 3 in. Closet Flange (Spigot)

NOTE 1—Adjustable plastic ring optional.

NOTE 2—Knockout optional in all configurations.

NOTE 3—Adjustable metal ring optional and must be protected by a corrosion-resisant coating.



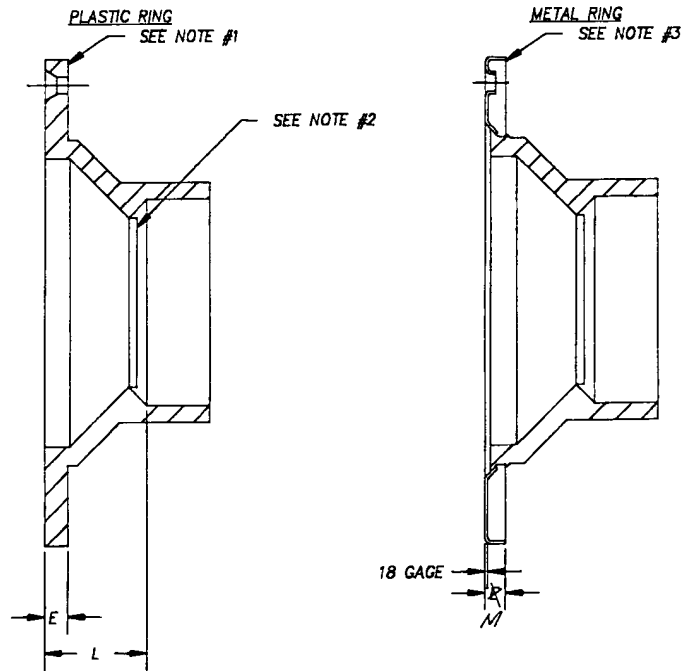
M (min)	E (min)	L (min)
$\frac{7}{32}$ (5½ )	$\frac{1}{4}$ (6)	$\frac{3}{4}$ (18)

TABLE 41 4 by 3 in. Closet Flange (HUB)

NOTE 1—Adjustable plastic ring optional.

NOTE 2—Knockout optional in all configurations.

NOTE 3—Adjustable metal ring optional and must be protected by a corrosion-resisant coating.



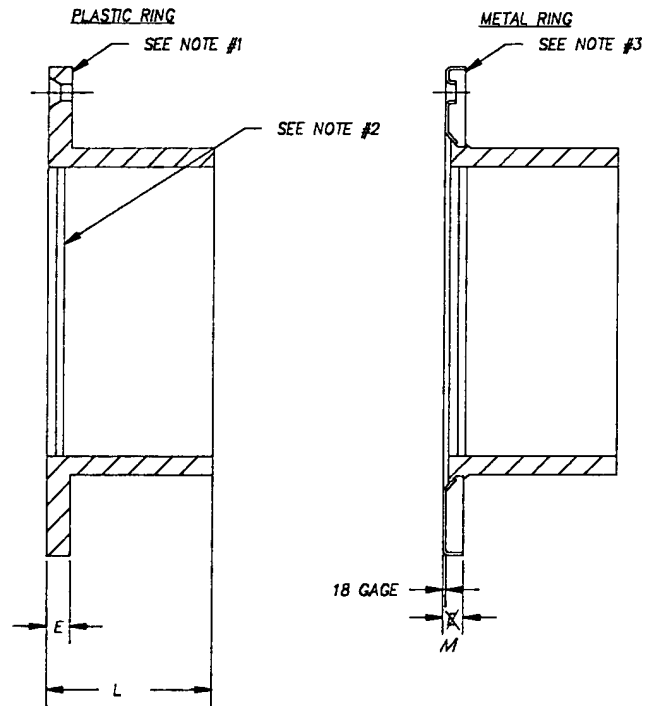
M (min)	E (min)	L (min)
$\frac{7}{32}$ (5½ )	$\frac{1}{4}$ (6)	$\frac{1}{4}$ (32)

TABLE 42 4 by 4 in. Closet Flange (HUB)

NOTE 1—Adjustable plastic ring optional.

NOTE 2—Knockout optional in all configurations.

NOTE 3—Adjustable metal ring optional and must be protected by a corrosion-resisant coating.



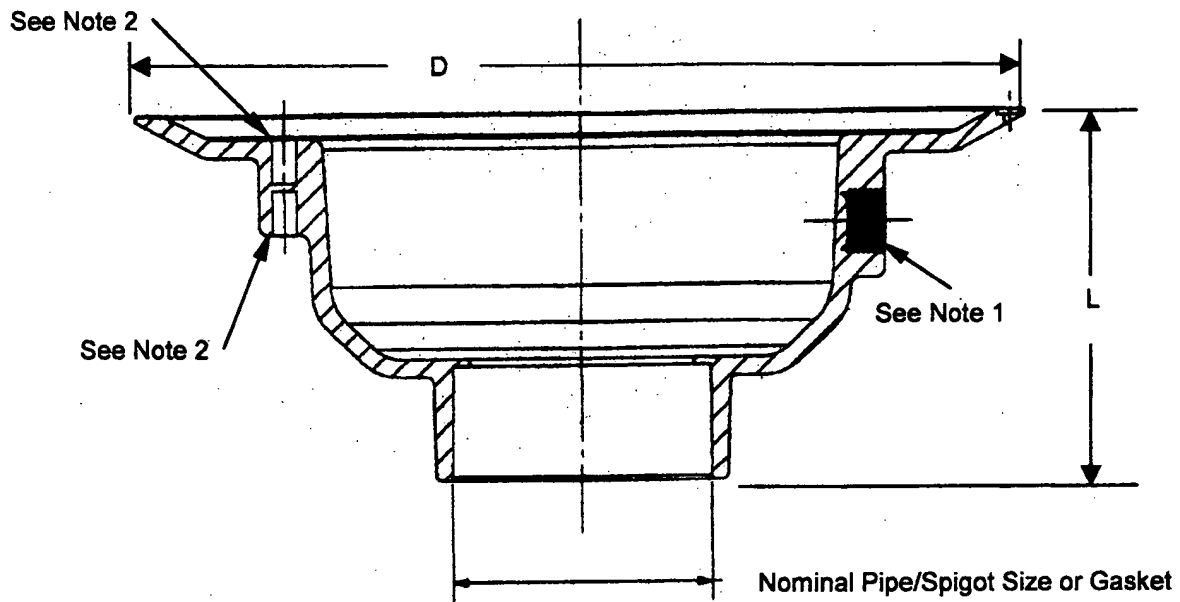
M (min)	E (min)	L (min)
$\frac{7}{32}$ (5½ )	$\frac{1}{4}$ (6)	2 (51)



TABLE 43 Drain Base Hub/Spigot for Roof, Floor and Sediment Drains

NOTE 1—½ in. FPT Primer Tap, Optional in All Configurations with Optional Knockout

NOTE 2—Inserts Used in Securing Clamping Collars or Underdeck Clamp, Optional in all Configurations Nominal Pipe/Spigot or Gasket Sizes: 1 ½ in., 2 in., 3 in., 4 in., 6 in.



Nominal Pipe Size	L	D
2	5.25 ± 0.10 (13.3 ± 0.25)	12 (30.5)
3	5.00 ± 0.10 (12.7 ± 0.25)	12 (30.5)
4	5.25 ± 0.10 (13.3 ± 0.25)	12 (30.5)
6	6.00 ± 0.10 (15.2 ± 0.25)	12 (30.5)



TABLE 44 4 by 3in. Offset Closet Flange (Hub)

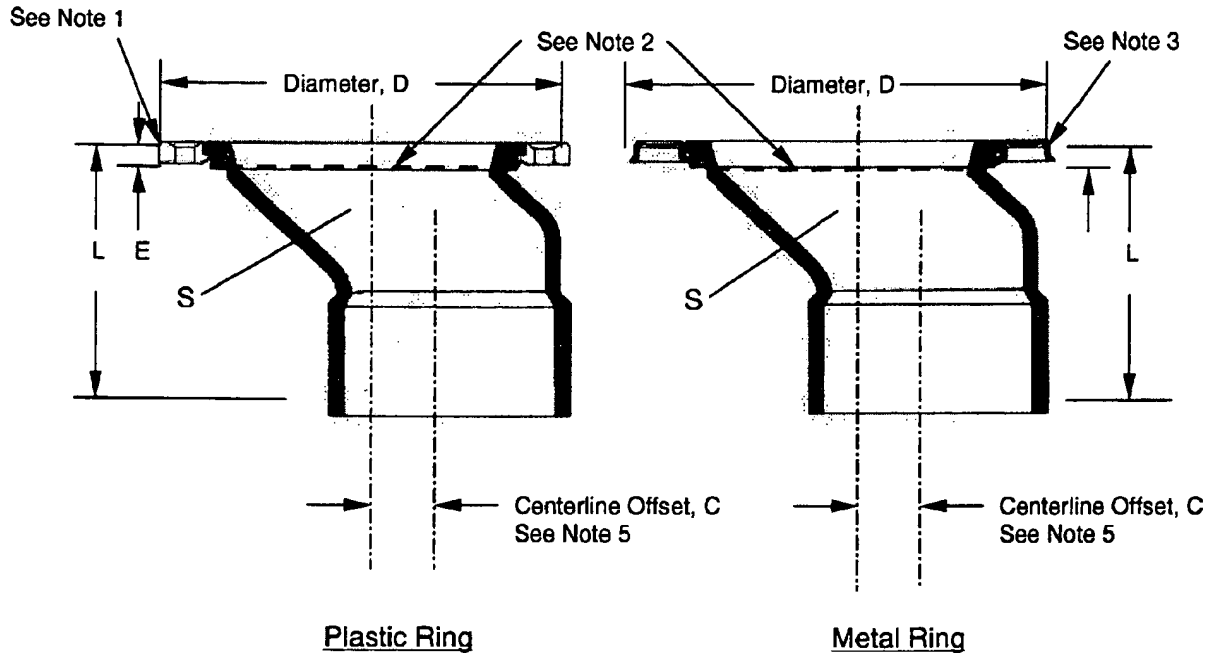
NOTE 1—Adjustable Plastic Ring Optional

NOTE 2—Knockout Optional in all Configurations

NOTE 3—Adjustable Metal Ring Optional Cylinder B must be Free of Ledges and Corners and must be protected by a corrosion-resistant coating

NOTE 4—Cylinder S must be Free of Ledges and Corners

NOTE 5—Offset, Centerline to Centerline



L, Typical Height	C, Offset	D, Diameter	E, Flange Thickness
$4.5 \pm \frac{1}{8}$ (11.4 $\pm$ 0.32)	$2 \pm \frac{1}{4}$ (5.1 $\pm$ 0.64)	$7 \pm \frac{1}{4}$ (17.8 $\pm$ 0.64)	$\frac{1}{4}$ min. (0.64)

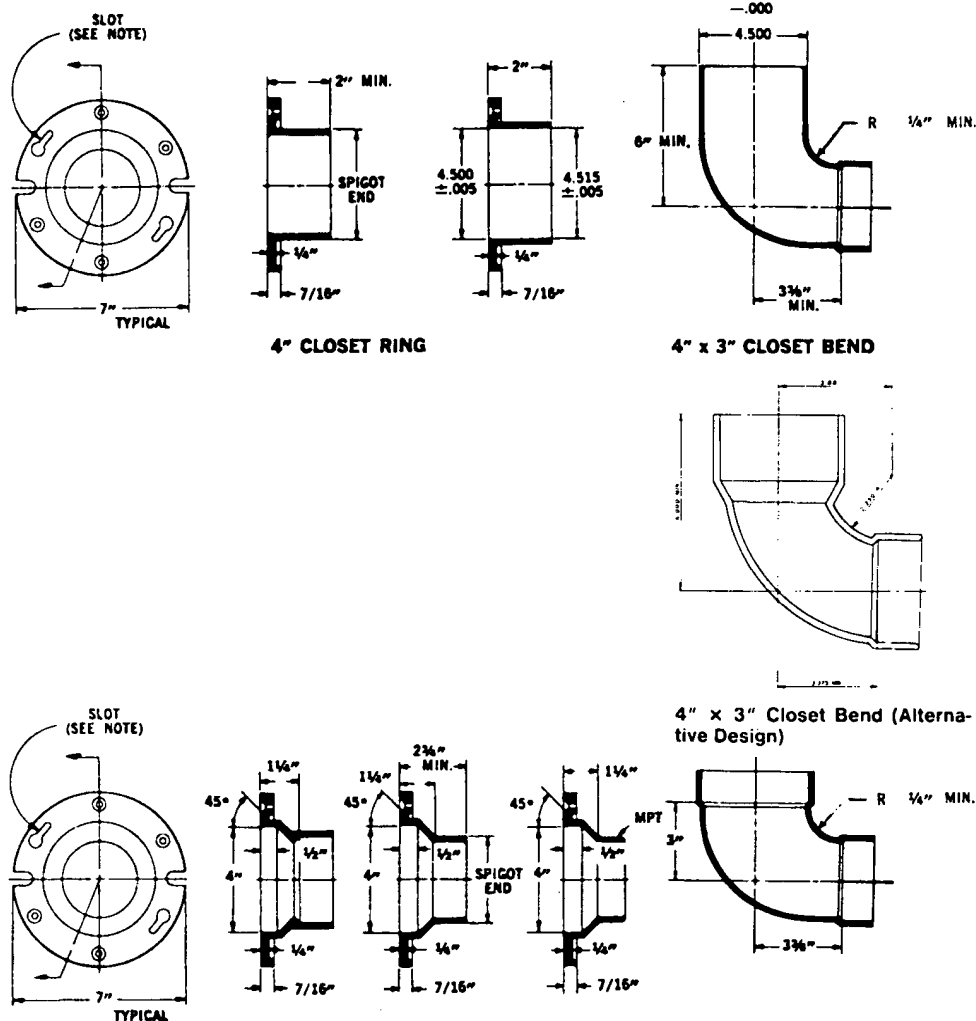


FIG. 1 Closet Rings and Closet Bends<sup>A</sup>, in.

NOTE-Slot is optional if fully reinforced with a corrosion-resistant material.

<sup>A</sup> All dimensions minimum, unless otherwise noted.

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